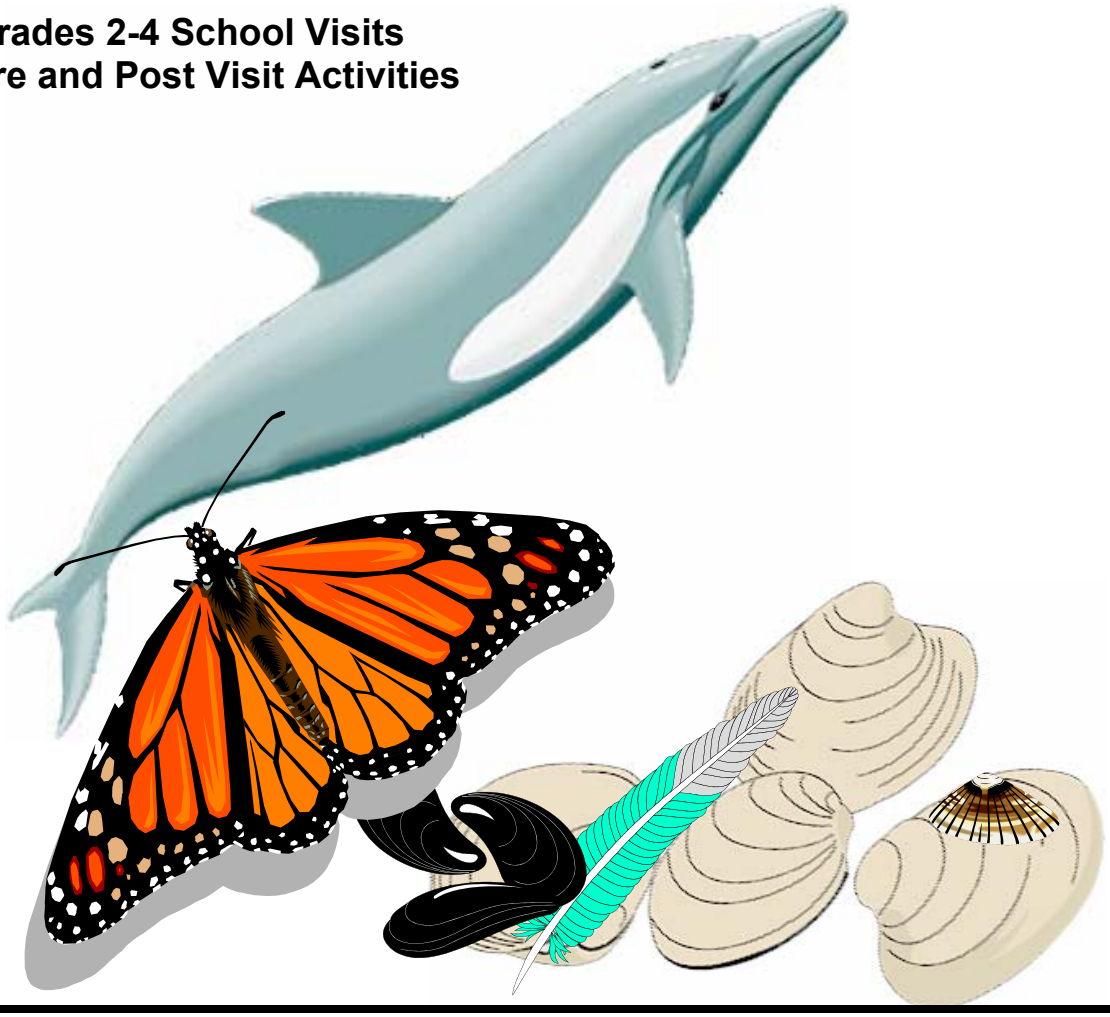
BEACH STUDY

ASSATEAGUE ISLAND NATIONAL SEASHORE

Grades 2-4 School Visits
Pre and Post Visit Activities



INTRODUCTION

Thank you for selecting Assateague Island as a school visit location. What better way for students to learn about their environment than by experiencing a living classroom? You can make this visit an even more memorable one by creating a sense of anticipation. Try some of the pre and post visit activities in this packet to spark your students imaginations in preparation for their field trip.

Students arriving with prior knowledge of the resource will be better prepared to explore and retain what they learn during the program. Post visit activities can help students evaluate the experience and incorporate new information and ideas into relevant classroom discussion.

Please hold on to this set of materials so it can be used again next year.

Staff at Assateague Island National Seashore hope your school visit will be productive. Please fill out the attached evaluation. We are interested in your comments.

"Sandcerely"

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Maryland Voluntary State Curriculum

Life on Sandy Shores
Grade 2
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Seek information from readings, investigations, and/or oral communication.
B. Critical Thinking. 1. Describe the similarities and differences among objects, materials, and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to make decisions about an identified, relevant science issue.
D. Technology. 1. Recognize and explain that a model can be used to learn something about an object.
E. History of Science. 1. Recognize that people have investigated the world around us, answered scientific questions, and invented things.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
D. Astronomy. 3. Identify and describe the repeating patterns of celestial events.

4. Chemistry – Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations.
B. Physical and/or Chemical Changes. 1. Identify and describe processes that can be used to change physical properties of materials.

6. Environmental Science – Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.
C. Natural Resources and Human Needs. 1. Recognize and explain how Earth's natural resources from the natural environment are used to meet human needs.
D. Environmental Issues. 1. Recognize and describe that the activities of individuals or groups of individuals can affect the environment.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Life on Sandy Shores
Grade 3
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 11. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe the similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to make decisions about an identified, relevant science issue.
D. Technology. 1. Recognize and explain that a model can be used to learn something about an object, event, or situation.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
A. Materials and Processes That Shape A Planet. 1. Recognize and explain how physical weathering and erosion cause changes to Earth materials.

3. Life Science – Students will use scientific skills and processes to explain the dynamic nature of living things.
A. Cellular. 1. Recognize and explain that there are some organisms too small to be seen clearly with the unaided eye.
C. Evolution. 1. Describe how physical structures of plants and animals enable organisms to live in water and land environments.
E. Ecology. 1. Recognize and explain how the basic needs of organisms are provided by their habitats.

6. Environmental Science – Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.
D. Environmental Issues. 1. Recognize and explain the consequences that may occur when Earth's natural resources are used to meet human needs.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Life on Sandy Shores
Grade 4
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to make decisions about a relevant science issue.
D. Technology. 1. Recognize and explain how the changes made to models can apply to real objects, events, and situations.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
E. Interactions of Hydrosphere and Atmosphere. 1. Recognize and explain the relationship of the sun to the water cycle.

3. Life Science – Students will use scientific skills and processes to explain the dynamic nature of living things.
C. Evolution. 1. Recognize and explain that organisms and groups of organisms that are best suited to an environment survive and reproduce.

6. Environmental Science – Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.
B. Interdependence of Organisms. 1. Recognize and explain that Earth's surface features and environmental conditions limit what types of organisms can survive.
D. Environmental Issues. 1. Recognize and describe that people depend on, change, and are affected by the environment.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

VIRGINIA STANDARDS OF LEARNING

Programs presented in the Chincoteague National Wildlife Refuge

Assateague Island National Seashore Virginia District

Beach Study Grades 2- 4

Indicators (Programs will vary. Selected indicators will be represented in pre/post visit materials and education programming.)

Grade 2

- 2.4 The student will investigate and understand that plants and animals go through a series of orderly changes in their life cycles.
- 2.5 The student will investigate and understand that living things are part of a system.
- 2.6 The student will investigate and understand basic types and patterns of weather.
- 2.7 The student will investigate and understand that weather and seasonal changes affect plants, animals, and their surroundings.
- 2.8 The student will investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature.

Grade 3

- 3.4 The student will investigate and understand that behavioral and physical adaptations allow animals to respond to life needs.
- 3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains
- 3.6 The student will investigate and understand that environments support a diversity of plants and animals that share limited resources.
- 3.7 The student will investigate and understand the major components of soil, its origin, and importance to plants and animals including humans.

- 3.8 The student will investigate and understand basic sequences and cycles occurring in nature.
- 3.10 The student will investigate and understand that natural events and human influences can affect the survival of species.

Grade 4

- 4.4 The student will investigate and understand basic plant anatomy and life processes.
- 4.5 The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment.
- 4.8 The student will investigate and understand important Virginia natural resources.

TEACHER'S BEACH VOCABULARY SHEET

- Please choose the appropriate vocabulary words to use with your class.
- The underlined portion of each definition is simplified and may be used with younger students.
- The portion of the definition not underlined is provided for teachers, but may be used with older students.
- This list accompanies Assateague Beach Bingo.

arthropods - means "jointed legs"; these animals have exoskeletons; sea spiders, spiders, mites, horseshoe crabs, crustaceans, insects
beach – the area where the ocean meets the land; Assateague's beach is made of sand
bivalve – an animal with two shells; a mollusk with two valves
camouflage – animals that blend in with their surroundings; animals use their color, patterns and shapes to accomplish camouflage
carnivores – a meat eater
cartilage - "rubbery" bones; sharks, rays and skates are cartilaginous fish
clam – an animal with two rounded shells and filters plankton for food; a bivalve that lives below the surface of the bottom, clams use siphons for filter feeding, clams are able to move with their muscular foot
consumers - animals can not produce their own food; consumers must eat plants or other animals
decomposers – microscopic organisms that cause dead plants and animals to rot or decay; organisms, mainly bacteria, that break down dead plants and animals into simpler substances
dune – a large mound of sand formed around plants; sand moved by wind and waves collects around vegetation to form mounds known as dunes, dunes move and change with the wind and waves
endangered – only a few animals or plants of a certain kind are left alive; a plant or animal in danger of becoming extinct
exoskeleton – animals with bones on the outside of their body; animals with an external skeleton. Mollusks and arthropods have exoskeletons covering and protecting the animal.
extinct - a certain kind of animal or plant is completely gone from the earth
filter feeders – animals that filter water for food; microscopic plants, animals and detritus are filtered from the water for food
flounder – flat fish with excellent camouflage for survival; flounders have both eyes on one side of their body, the eyeless side faces down and is usually white
food chain - sunlight helps plants grow, plants are eaten by animals, animals are eaten by other animals; a passage of energy, where plants or producers are food for animals (consumers)
fresh water - drinking water, rain water; water that does not contain dissolved salts
gastropod - means "stomach foot", a univalve, a one-shelled animal
habitat - an animal's natural home; must provide food, water, shelter and space
herbivore – plant eater
horseshoe crab – A crab that's not really a crab! Horseshoe crabs are more closely related to spiders, ticks and scorpions than true crabs; horseshoe crabs are harmless, ancient creatures surviving and living on earth since before the dinosaurs
invertebrate - an animal without a backbone
island - land surrounded on all sides by water
mollusk - the group of animals containing univalves, bivalves and cephalopods

mussels – an animal with two thin, narrow shells and filters plankton for food; mussels attach in one place with special threads called byssal, blue mussels and ribbed mussles are common at Assateague
omnivore – plant and animal eater
piping plover – a small endangered shorebird that nests on wild, natural beaches; piping plovers are small sandy-colored shorebirds, coastal development has destroyed most of the piping plover's habitat
predator - an animal that hunts and kills other animals for food
plankton - microscopic plants and animals living in salt water and fresh water
producers – plants; produce their own food with energy from the sun through the process of photosynthesis
salt water - ocean water; contains dissolved salts
sand – rocks broken down into tiny pieces; Millions of years of rain and climatic changes break down mountains. Very small pieces of rock are carried down from mountain tops by streams and rivers and deposited along the coastline. This sand now forms barrier islands with beautiful beaches.
scavenger - an animal that eats dead leftover animals and plants
school - many of the same kind and same size of fish swimming together; fish swim in schools for protection from predators
scrape – a nest "scraped" on the beach by shorebirds; a shallow nest depression formed in the sand on a high area of beach by shorebirds
sea star – star-shaped animals with arms connected in the center of the body; sea stars have a mouth in the center of their arms on the bottom side of their body, sea stars move with rows of tiny tube feet, sea stars are predators
shell – the skeleton of a snail, clam or mussel; the exoskeleton made by a univalve or bivalve
skate – a flat harmless fish with "rubbery" bones; skates are cartilaginous fish related to rays and sharks
skate egg case – nicknamed "mermaid's purse"; a black casing that protects a baby skate during its development before it is born
skeleton – bones or shells that support and protect an animal's body; skeletons provide attachment for muscles
snail – large and small animals with one shell on their back; most snails have a large muscular foot for movement, a radula for feeding, tenacles, eyes, and an operculum to seal the opening in their shell
telson – a horseshoe crab's tail; the last abdominal segment in a crustacean or horseshoe crab
tides - the periodic rise and fall of the sea level along the coasts resulting from gravitational forces of the moon and the sun on the earth
univalve - an animal with a one piece shell
vertebrate - animal with a backbone
waves - wind moving over the surface of the water creates wave action
whelks – beautiful large sea snails found in the ocean near Assateague Island; Channeled whelks have smooth spiraled shells, Knobbed whelks have knobby spiral shells
wind - the movement of air between two different places

ASSATEAGUE ISLAND BEACH BINGO

Generalization: The place where land and water meet is a dynamic zone full of hidden treasures.

Objectives:
1. Students will be able to define at least 3 words or phrases from the Beach Vocabulary list.
2. Students will be able to identify some of the animals associated with the beach/ocean habitat.

Preparation: Make enough copies of the bingo sheet for each student. Select words or phrases from the vocabulary list to use in the bingo game. Collect a few prizes should you choose to present awards to winners.

Materials: Bingo sheets, chips (if you are doing the simplest form of the game), awards, colored pencils.

Procedure:
Have a little fun with vocabulary words while preparing students for their visit to the island. Assateague Island Bingo is designed to introduce students to vocabulary associated with the ocean/beach environment.

The game may be played in a variety of ways depending on age and ability.

<u>Youngest students</u>

1. Select 9 words from the vocabulary list and print them on the board.
2. Distribute bingo sheets and chips.
3. Discuss words and what they mean. (You might write a short definition next to each word.)
4. Have students print each vocabulary word in whichever block they choose so that each bingo sheet is different.
5. Make sure the students understand that every block should be filled with a word. When the students are ready, tell them that you will be calling out a definition. Students should match the definition to a word in one of the blocks and place a chip in that location.

6. When a student has 3 across, down or diagonally, he/she calls out "Assateague!"
7. Students must review their 3 vocabulary words and give each definition. If all three words and definitions are correct, the students wins!
8. Teachers! Remember to keep track of each word and definition called out!

More challenging

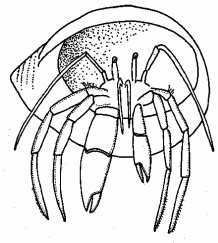
1. Select 9 words from the vocabulary list and print them on the board.
2. Distribute bingo sheets.
3. Discuss words and provide a short definition.
4. Have students write each definition (or descriptive phrase) in whichever block they choose so that each bingo sheet is different. They must also leave room to write the matching vocabulary word.
5. Make sure the students understand that every block should display a short definition (and room to write the matching vocabulary word). No empty blocks.
6. Once students are ready, begin calling out vocabulary words.
7. Students must match the correct definition to each vocabulary word. They should write these in a bright colored pencil so they can easily tell when they have 3 across, down, or diagonal.
8. A student should call out "Assateague!" when they have 3 in any direction. In order to win the game they must have matched the correct vocabulary word and definition.

Even more challenging

1. Select 10 or more words from the sheet or those you wish to cover from your own list. Explain to students that they will pick out 9 of these to write into blocks for the game.
2. Follow directions 3 through 8 from above description.

Most challenging

1. Distribute the 16-block bingo sheet.
2. Select 16 vocabulary words.
3. Follow directions 3 through 8 from above description.



INSIDES OUT OR..... SHELLS ARE SKELETONS!

Seashells are probably more familiar to us than the creature living inside! Many of us may not realize that a living creature created a seashell. Just as humans have a skeleton that supports the body and provides attachment for muscles, so do mollusks and crustaceans. Their shells are exoskeletons, or external “bones.”

Mollusks

The soft bodies of mollusks need their shells for support and protection from predators and environmental conditions such as temperature, tides and weather. Mollusks do not discard their shell and find a new one. Larval (young) mollusks form a shell in their early stages and the shell will continue to grow as the mollusk grows for the rest of its life. A thin tissue layer surrounding the body called the mantle produces the shell. Shell material, calcium carbonate and other organic chemicals, are secreted into a space between the mantle and the shell in a successive building process. Colorful mollusk shells are produced by pigment cells in the mantle. The shape of a shell is genetically inherited.

When a mollusk dies, the shell is the skeletal remains of the creature. Empty shells are used by hermit crabs, which have no shell of their own, or as homes and hiding places for many other creatures. As a shell breaks down, it becomes part of the sand and eventually the minerals are returned to the ocean water. Collection of empty shells should be done in moderation, if at all. Return shells to the beach after examining or studying them. Unfortunately, many species of mollusk have almost vanished due to irresponsible collectors actually taking live mollusks and killing the animal for its shell.

Crustaceans

Crustaceans have an external skeleton or exoskeleton covering their body like a suit of armor. As a crustacean increases in size, its shell does not, so it must molt or shed its shell in order to grow. This periodic molting is hormonally controlled.

A layer of tissue underneath secretes the shell covering of a crustacean. When a crustacean is preparing for molting, the tissue layer separates from inside the hard exoskeleton and begins to secrete a new exoskeleton. At this time, the crustacean has two skeletons! The old outer shell is hard and too small to accommodate the creature, while the new soft inner skeleton is ready to emerge. The old outer skeleton will begin to split at certain weak spots (depending upon species). The crustacean will then pull its body out of the old shell, take in water and stretch the new soft-shell to its full size. The new shell will then harden in a short period of time.

Prior to a molt, crustaceans usually become sluggish and find a sheltered area. Once the creature has molted its shell, their soft bodies are vulnerable and defenseless until their new shell hardens. Some crustaceans eat their old shell to absorb needed calcium salts. Crustaceans are able to regenerate lost limbs through successive molts. Molting tends to be less frequent with age.

SHELLOOO TO SHELLS!

Generalization: Many ocean (and bay) creatures have shells. The shells are their "bones".

Objectives:
1. Students will learn why some creatures need shells.
2. Students will be able to distinguish between a univalve, bivalve and crustacean.
3. Students will identify creatures that make their own shells and those who use "old" shells.
4. Students will learn some mollusk and crustacean habits.

Preparation: This lesson will require a collection of Assateague shells and carapaces. Friends, neighbors and other teachers may be able to assist by loaning or donating items to your class.

Materials: Insides Out fact sheet, Horseshoe Crab fact sheet.
Possible Shells to use:

Univalves = moon snail, whelks
Bivalves = scallop, angel wing, arks, clams, mussels, coquina
Crustaceans = spider crab, lady crab, rock crab, mole crab, ghost crab (Horseshoe crabs are not in the class Crustacea, but are phylum Arthropoda like the crustaceans. Horseshoe crabs are class Merostomata. They are more closely related to spiders than crabs. If you choose to use the Horseshoe crab in this lesson be sure to make the distinction.)

Drawing paper, Shelloooo Worksheet, handwriting paper, crayons and markers should also be included.

Procedures:
This is an orientation activity designed to introduce students to creatures that live in shells and to introduce the concept of "shells as skeletons." Divide class into cooperative learning groups. (Number of groups will depend on how many shells you choose to use) Give a shell to each group of students. Explain that these creatures live in or near the ocean or bay. Shells can function as an animal's home. Shells offer protection from predators and environmental conditions (weather conditions, wave action). Shells are the animal's "bones" or skeletons! They are made by the animal

living inside. Some shells “grow” as the animal grows and some “shells” (chitinous exoskeleton of arthropods) must be shed in order for the animal to grow.

Ask the students to imagine what lives in the shell given to their group. If the students know what lives in the shell, great! If they do not know what lives in the shell, even better! Let them use their imagination. As a group or individually, ask students to draw a picture of their creature (whether real or imaginary). Use the Shellooo Worksheet or the chalk board to make a list of questions for students to respond to:

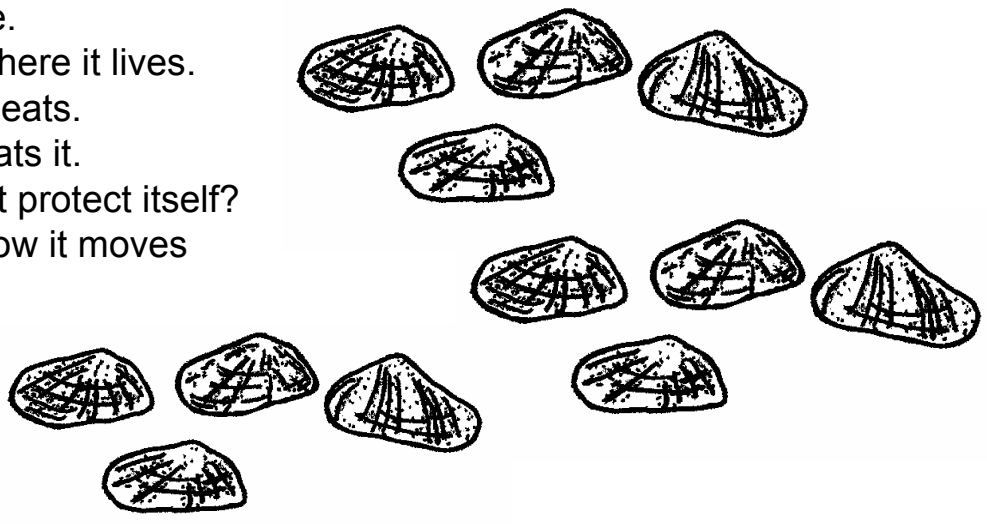
- What is the name of your creature?
- Where does it live?
- What does it eat?
- What eats it?
- How does it protect itself?
- How does it move?

Ask the students to consider these questions. The class will not have any prior information, so they will have to think about their creature and use their imaginations. Some creatures created by students may be very imaginative and unrealistic, this is fine. Provide worksheets for students to respond to each question. Have a few students from each group share their creature with the class and discuss its habits.

Discuss the “real” inhabitant of each shell.

Name each creature.

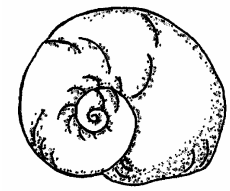
- Describe where it lives.
- Tell what it eats.
- Tell what it eats.
- How does it protect itself?
- Describe how it moves



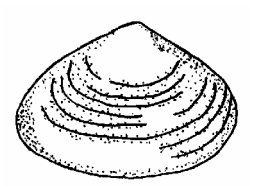
Discuss the different groupings of creatures:

Mollusks (univalves and bivalves) filter water through their body and extract calcium carbonate and other chemicals from the water. A part of the animal's body called the **mantle** secretes the shell material. These chemicals are secreted through the outer margin of the mantle to the edge of the shell in a building process. The shape of the shell is already determined by inheritance! Most mollusks reach their full size in 1 to 6 years. Growth rings may be present and represent changes in salinity and temperature and may coincide with the seasons, but do not necessarily indicate the age. Generally, shell growth is more rapid in warmer water.

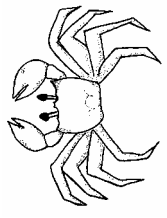
Univalves are mollusks that have one shell. (As a memory aid, this may be compared to a "unicycle" that has only one wheel.) Some univalves that live in the ocean habitat near the beach are moon snails, whelks and slipper shells (Slipper shells *look like* half of a bivalve). Periwinkles and Coffee Bean snails are associated with local salt marshes. Most univalves have a head, tentacles, eyes, a siphon and a radula (tongue-like organ for feeding), but there are exceptions. Univalves usually have a muscular foot for movement. Their single shell acts as a lifelong portable shelter and will grow with the animal. The muscular foot usually has a "door" or operculum attached and will close off the shell opening to protect the creature from a predator or drying out.



Bivalves are mollusks with two shells. (As a memory aid, this may be compared to a "bicycle" which has two wheels.) Some bivalves that live in the ocean habitat near the beach are scallops, arks, jingles, surf clams, and angelwings. Hardshell clams and oysters are bay creatures. Bivalves are hinged on one side and have a large muscle(s) that pulls the shell shut. Bivalves have soft bodies and some have a foot for burrowing. In burrowing bivalves, two siphons or tubes extend from the shell to the surface to draw in water in order to feed. Other bivalves open their shells and filter water across their bodies.

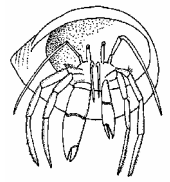


<u>Crustaceans</u> (crabs, shrimp, lobsters) must molt or shed their shell in order to grow, unlike mollusks. Crustaceans have a continuous shell covering over their bodies like a suit of armor that does not grow with the animal! Molting takes place at regular intervals, depending upon particular species and environmental conditions. When the crustacean is about to outgrow its shell, the outer shell, stomach lining, and gills are shed. The animal pulls itself out of its old shell, often with great difficulty, and emerges with a very soft new shell. The creature is left a defenseless and vulnerable creature until the new shell hardens. The crustacean circulates water to swell and stretch the new soft shell tight. The new shell will be markedly larger than the previous smaller shed (or molted) shell. It will completely harden in about 48 hours.



Discuss what might happen to empty shells.

- People might collect shells from the beach. Never collect any shell with a live creature inside.
- Hermit crabs may find an empty shell to live in. Hermit crabs have soft bodies and must find an empty shell for protection. Will they be looking for a bivalve or a univalve?



- Other creatures, like barnacles, tube worms, or slipper shells may make their home on discarded shells. They need a hard surface where they can attach.
- Shells will eventually break apart in the waves and become part of the sandy beach. As the shell material breaks down further, minerals will be released back into the water.

While the students are still in groups with their assigned shell, compare their creatures with the “real” creatures.

Questions to consider.....

1. How do the creatures differ in:
    - Appearance
    - where they live
    - what they eat
    - what eats them
    - how they protect themselves
    - how they move

2. Which creatures are univalves, bivalves and crustaceans? If you used the Horseshoe crabs--Which creature is related to spiders?
3. How many of these creatures have students ever seen?
4. Do we eat any of these creatures? Have any of the students eaten any of these creatures or would they like to try?
5. Are any of these animals dangerous to humans? How?

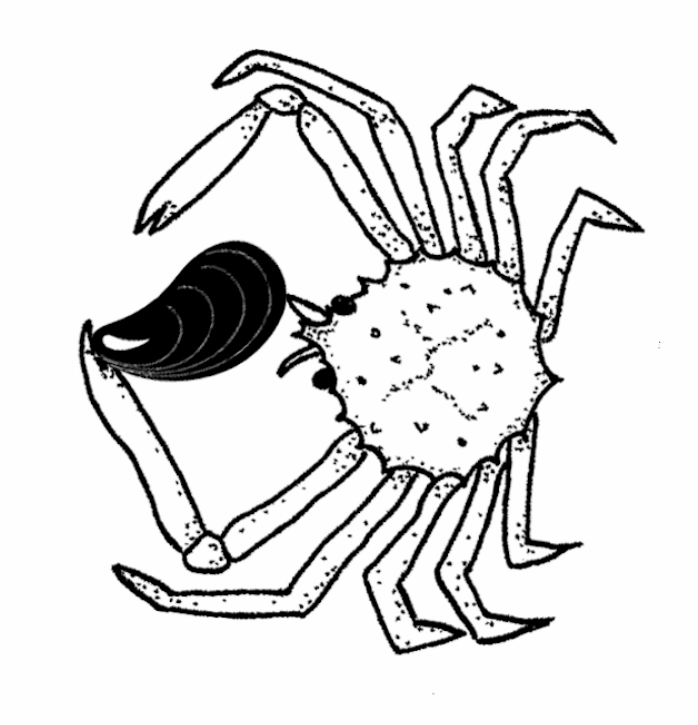
Extensions:

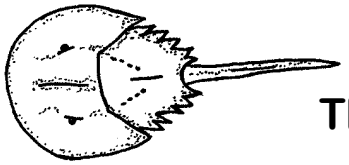
Prepare a bulletin board with pictures and descriptions of each “real” creature and students imaginary creature. Send copies of the imaginary creatures to park staff.

Visit the “Monster Exchange” web site. Keeping with the “Monster Exchange” idea, a “sea creature exchange” might be attempted. A sea creature could be described to another student, class, or school and a response (a picture) is made from the description. This type of activity could be performed between students (as an individual learning center activity), or between classrooms, or schools, or even long distance between classes/schools!
http://members.home.net/brunner/projects/monster.htm

Include mollusks and crustacean names in your vocabulary list.

Play “What am I” or “Simon Says” with the types of mollusks and crustaceans learned.





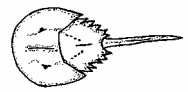
The Horseshoe Crab

Fact Sheet

- **<u>Horseshoe Crabs are completely harmless creatures!</u>**
- **The Horseshoe Crab is more closely related to ticks, spiders and scorpions than other crabs.**
- **The Horseshoe Crab has been living in the ocean for at least 250 million years…well before dinosaurs roamed the earth! It is sometimes called a "living fossil" since the species has not changed in appearance over millions of years.**
- **The Horseshoe Crab can be found from the coast of Maine to the Yucatan Peninsula.**
- **The Horseshoe Crab can grow up to 36 inches in length including the tail.**
- **Horseshoe Crabs can live for at least 15 years.**
- **Female Horseshoe Crabs grow larger than the males and can weigh up to 10 pounds.**
- **Horseshoe Crabs are classified as invertebrates (they have no backbone).**
- **Horseshoe Crabs have an exoskeleton (external skeleton), which they must shed in order to grow larger.**
- **Their bodies are divided into three parts; a helmet-shaped front shell, a hinged middle section, and a long spike tail.**
- **The tail, or telson, is not a defense mechanism. It is used to turn themselves right side up when they are upside down.**
- **Horseshoe Crabs have many eyes. They have two large compound eyes on either side of the outer helmet which can magnify sunlight 10 times! Two simple eyes at the front of their helmet sense ultra violet rays from the moon. They also have 5 eye spots and light sensors on their tail!**
- **Horseshoe Crabs have 5 pairs of legs. The first four pairs of legs are for walking and each is out fitted with a claw at the tip. The fifth pair of legs are used for propulsion along the bottom and acts kind of like a ski pole. Each leg is joined at the opening to the mouth with bristly grinders. These bristles act as teeth and crush food as it moves into the mouth. This "chewing" action is only possible when the legs are moving. So the Horseshoe Crab has to move or wiggle its legs to eat!**
- **What do they eat? Mostly sea worms and clams, but they can go for up to a year with out eating anything at all. Horseshoe crabs serve as a primary food source for the juvenile loggerhead turtle.**
- **Male Horseshoe Crabs have "boxing glove" shaped claws on their first pair of legs. These specialized clasper claws are used for attachment at the back portion of the female Horseshoe Crab's shell during spawning.**

- **During high tide nights in May or June, the female will drag the attached male (or males, sometimes 3, 4, or 5!) up on ocean or bayside beaches. Here she will lay many clutches of eggs in the sand.**
- **Female Horseshoe Crabs can carry up to 88,000 eggs (each clutch can hold up to 4,000). After the eggs are laid, the female will then drag the male over them for fertilization.**
- **Many migratory shorebirds depend on this spectacular Horseshoe Crab spawning event for nourishment on their annual journey north to breeding grounds as far north as the arctic circle.**
- **In about two weeks, at high tide, baby horseshoe crabs will hatch from their eggs. These larval Horseshoe Crabs bear a striking resemblance to their parents, they are a much tinier, tailless, version.**
- **Once harvested by the ton in the 1900's to be dried and used for fertilizer, the Horseshoe Crab is now used by man for much more important reasons. It's copper based blood turns blue when exposed to oxygen. Medical researchers have discovered a component of this blue blood is capable of detecting poisons in human blood. The Horseshoe Crab's blood has become a precious resource in checking purity of medications intended for human use. Blood is drawn from the Horseshoe Crab and the crab is released unharmed!**
- **Chitin from the shell of the Horseshoe crab is used to help skin grafts of burn patients heal faster.**
- **The Horseshoe Crab can survive doses of radiation that would kill a human.**
- **The Horseshoe Crab can endure extremes in temperature and salinity.**
- **Researchers believe a cure for cancer may lie buried in the secrets of this fascinating animal.**

HOORAY FOR HORSESHOE CRABS!!!!!



Generalization: The horseshoe crab is a living prehistoric relic. It is one of the most misunderstood creatures in the ocean!

Objectives:
1. Students will become familiar with the fascinating and harmless horseshoe crab.
2. Students will be able to identify horseshoe crab's relatives and habits.
3. Students will be able to explain the valuable role the horseshoe crab plays in the web of life.

Preparation: Review the horseshoe crab fact sheet. Make copies of the horseshoe crab patterns in advance. Construction paper will run through the copy machine one sheet at a time. This may help speed up the pattern making process. Make copies of the Horseshoe Crab Warm Up and review the warm up answer sheet.

Materials: Horseshoe crab fact sheet and warm up activity, horseshoe crab pattern, brown construction paper, scissors, crayons, markers, blue paint, glue or stapler

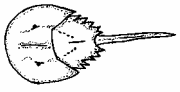
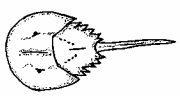
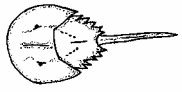
Procedure:
Do the Horseshoe Crab Warm Up as an anticipation exercise. Follow the instructions provided on the sheet.

Give each student a brown construction paper copy of the horseshoe crab pattern. Ask the students find the large head section of the horseshoe crab. Have students cut out the head section. Remind them to cut the small dotted line sections. At this point, review:

- *What is the function of the Horseshoe crab's shell?* It is for protection. It is the horseshoe crab's external skeleton.
- *How many eyes does the Horseshoe crab have?* The horseshoe crab has 2 large compound eyes on each side of the head, 2 small simple eyes on the front of the shell and 5 simple eyes under the front edge of the shell and at least one light sensor on the telson (tail). The horseshoe crab is able to see fairly well, sense light and darkness, and detect the phases of the moon. It cannot see colors, however.

Have students find the middle section of the horseshoe crab and cut it out. Review:

- *What is the function of this middle section of the horseshoe crab?* This section protects the horseshoe crab's respiratory organ, the book gills.
- *What is the function of the spines on this middle section?* The spines are movable and protect the horseshoe crab's gills. The gills are the only soft areas of the horseshoe crab's body. Predators like sea gulls or raccoons often feed on the gill area.

Have students find the tail section of the horseshoe crab and cut it out. Review:

- *What is the function of the horseshoe crab's tail or telson?* The horseshoe crab uses its tail as a mechanism for turning over if it finds itself on its back. The tail is also used as a bit of a rudder when the horseshoe crab is crawling or swimming. The tail is not a stinger, nor is it used as a weapon.
- *Why is it important not to pick a horseshoe crab up by the tail?* The tail may break off. A very small muscle attaches the tail to the middle section. It would be like picking a person up by the ear!
- *What happens to a horseshoe crab if its tail is broken off?* If the tail is broken off a horseshoe crab, infection may set in and weaken or kill the animal. If the horseshoe crab found itself on its back, it would be unable to turn over, thus becoming vulnerable to desiccation (if out of water) and predators.

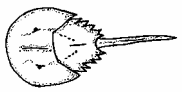
Have students find the leg parts of the horseshoe crab and cut them out. Review:

- *Can the horseshoe crab pinch you?* The horseshoe crab has very weak claws. The claws are designed for grasping soft marine animals such as worms and soft-shelled clams. If the horseshoe crab had sharp scissor-like claws, it would cut its food in half before it got to its mouth. The claws will hold on to your finger with a good grip but no pain!
- *How many legs does a horseshoe crab have?* The horseshoe crab has 5 pairs of legs. The first 4 pairs are for walking and feeding. The last pair act as ski poles and push the crab along the bottom.
- *Are there any differences between the male and female horseshoe crab's claws?* Yes! The first pair of claws on the horseshoe crab may tell you if it is a male or a female. A female has the typical scissor shaped claws. A male has "boxing glove" or "thumb's up" shaped claws designed for clasping onto the back portion of the female's shell during spawning. Young horseshoe crabs all have scissor shaped claws!
- *Can the horseshoe crab hurt you?* NO WAY! Horseshoe crabs do not bite, sting or pinch! Their mouth is located in the center of all the legs. The entrance to the mouth is bristly like a toothbrush. The horseshoe crab must wiggle its legs or walk in order to "chew" its food. The horseshoe crab looks scary, but its equipment poses no harm to humans, only worms and other soft creatures!

To assemble the horseshoe crab: *The teacher may choose to staple or tape the student's horseshoe crabs to save time, as gluing or pasting will have to allow drying time.

- Start with the head section. Attach the areas marked "a." Tuck outside "a" over inside "a" to achieve a 3-dimensional front shell.
- Next, attach the middle section to the head at "b." Put middle section "b" under head section "b" and attach.
- Attach the tail to the middle section at "c". Attach tail "c" under middle section "c."
- Last, attach the legs to the underside of the head section. The longest pair of legs is last and should be facing the tail.

Some other details to keep in mind:



- Horseshoe crabs often pick up “hitchhikers”! Barnacles, slipper shells, tubeworms and bryozoans may attach and find a home on the crab’s shell. These creatures do not harm the horseshoe crab. Horseshoe crabs must shed their shells many times in their life in order to grow larger. A new “clean” shell is free of “hitchhikers”, scratches and dings! An older shell will usually have scratches, dings and maybe a few “hitchhikers”. Students may want to decorate their horseshoe crabs with a few “hitchhikers”!
- Horseshoe crabs have copper based blood which turns blue when exposed to oxygen. This is unlike iron based human blood that turns red in the presence of oxygen. Horseshoe crab blood has been extremely valuable in medical research. Blood is extracted from the horseshoe crab without harm, and the crab is released. The blood is used in the study of diseases like Spinal Meningitis and cancer. A component of the horseshoe crab’s blood has proven to be invaluable in testing drugs before they are given to humans. The component, lysate, will clot in the presence of toxins thus indicating the drug is unsafe for humans.

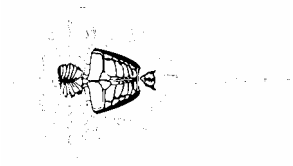
You might wish to repeat the warm up activity at this point.

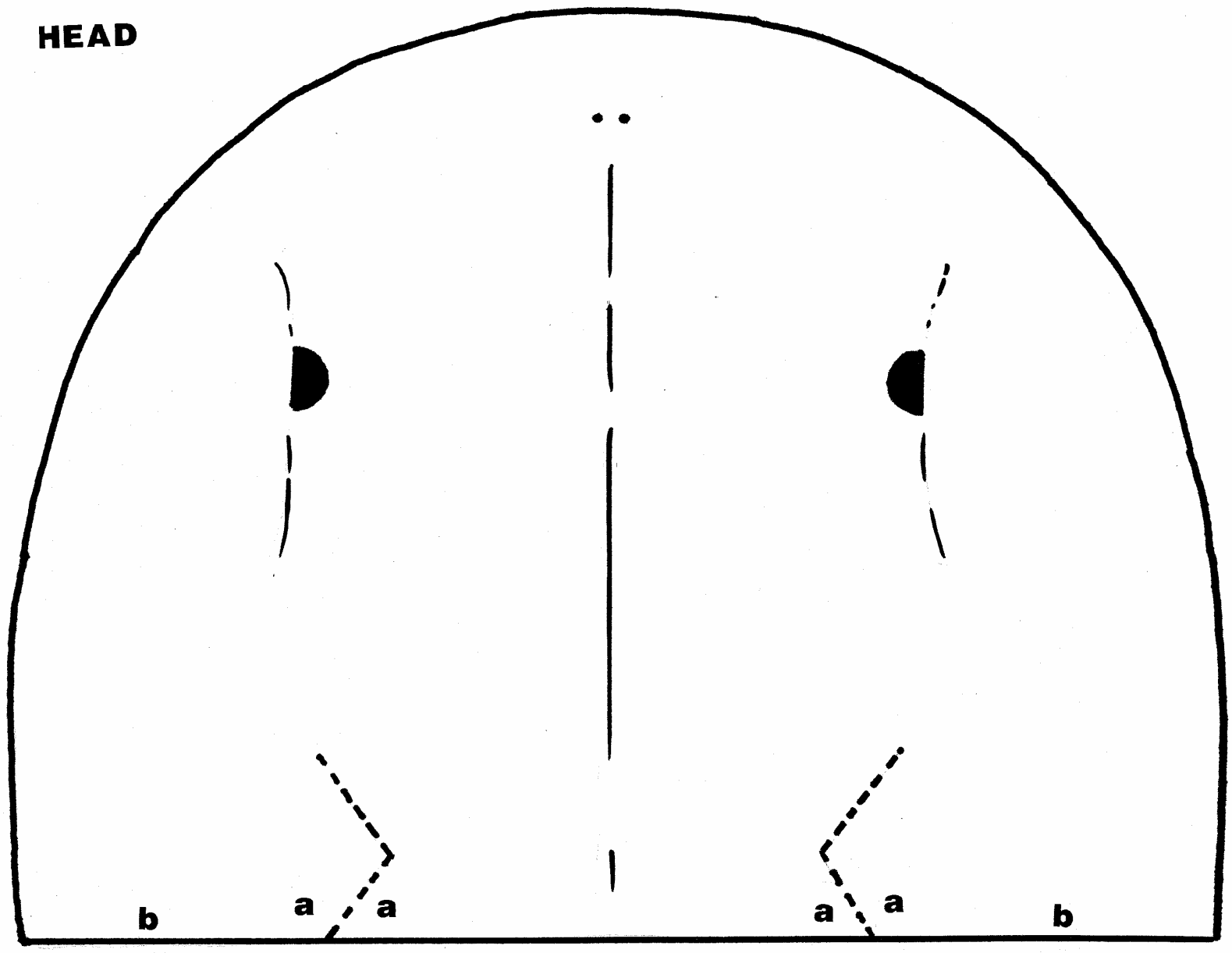
Horseshoe crabs are harmless, fascinating creatures. This one-of-a-kind creature deserves our attention. Horseshoe crabs migrate to the Delaware Bay region to spawn. Hundreds of thousands of horseshoe crabs crawl on the beaches to lay their eggs. Thousands of migrating shorebirds heading to breeding areas near the arctic circle depend on the horseshoe crab eggs for nourishment on this long journey. Horseshoe crabs are gathered from the beaches during this time by the thousands and loaded into trucks. They are being harvested by the boatload everyday, all for use as bait in eel and whelk pots. These practices have had a profound effect on the population of Horseshoe crabs in recent years. Their decline has in turn, caused a drastic decline in migrating shorebird species.

It is important for everyone to know that “scary, creepy-looking” creatures are not bad creatures. There is no “good” or “bad” in nature. Some creatures are dangerous and some are not. The horseshoe crab has survived over hundreds of millions of years, enduring drastic changes in global climates and ocean salinity, all to be possibly lost forever by the actions of people.

Extensions:

Visit the Delaware beaches during May and June to witness the horseshoe crab spawn. Contact Prime Hook National Wildlife Refuge, Delaware State Park System, or Delaware Department of Natural Resources for more information on spawning beaches to visit.

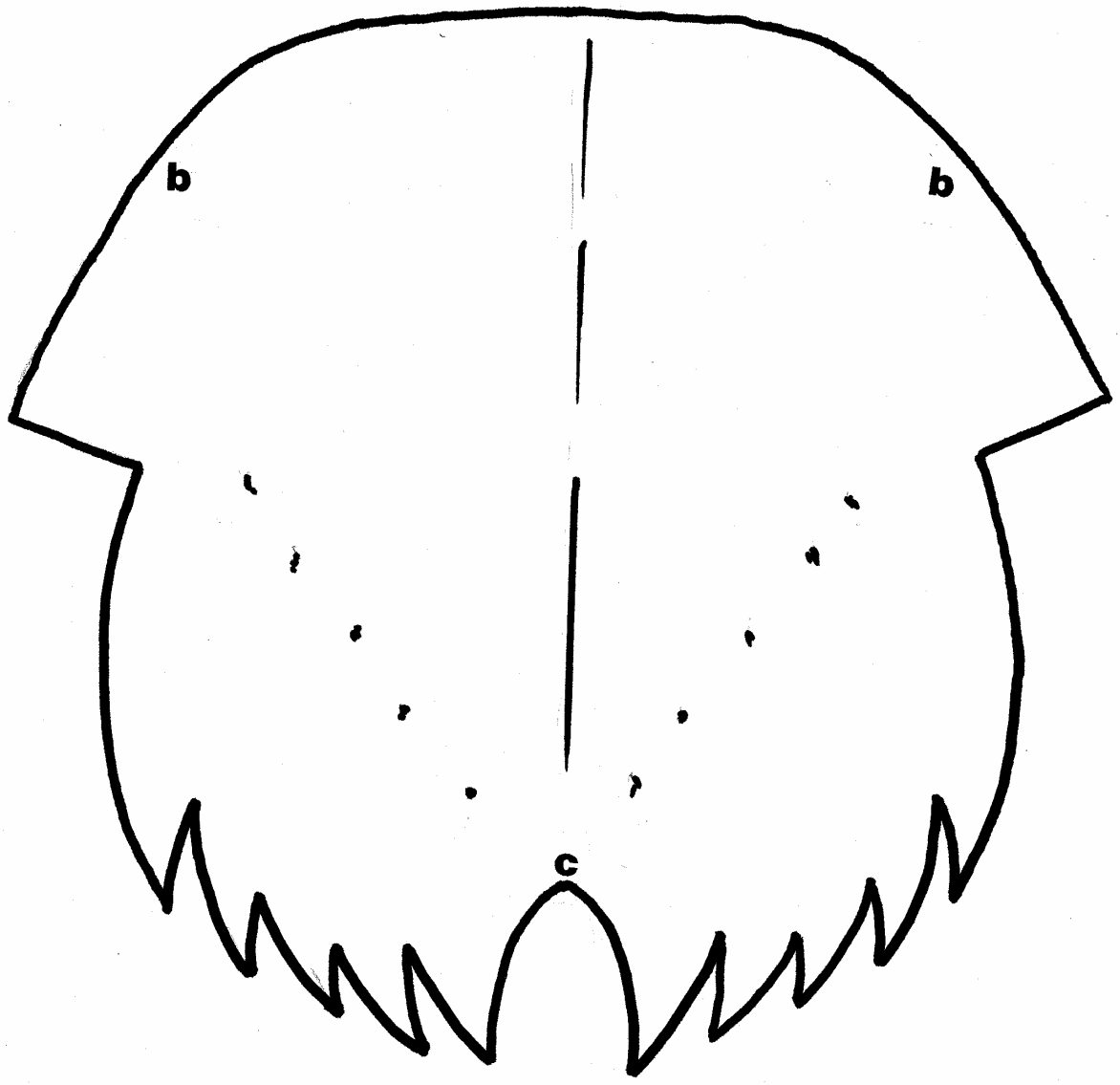




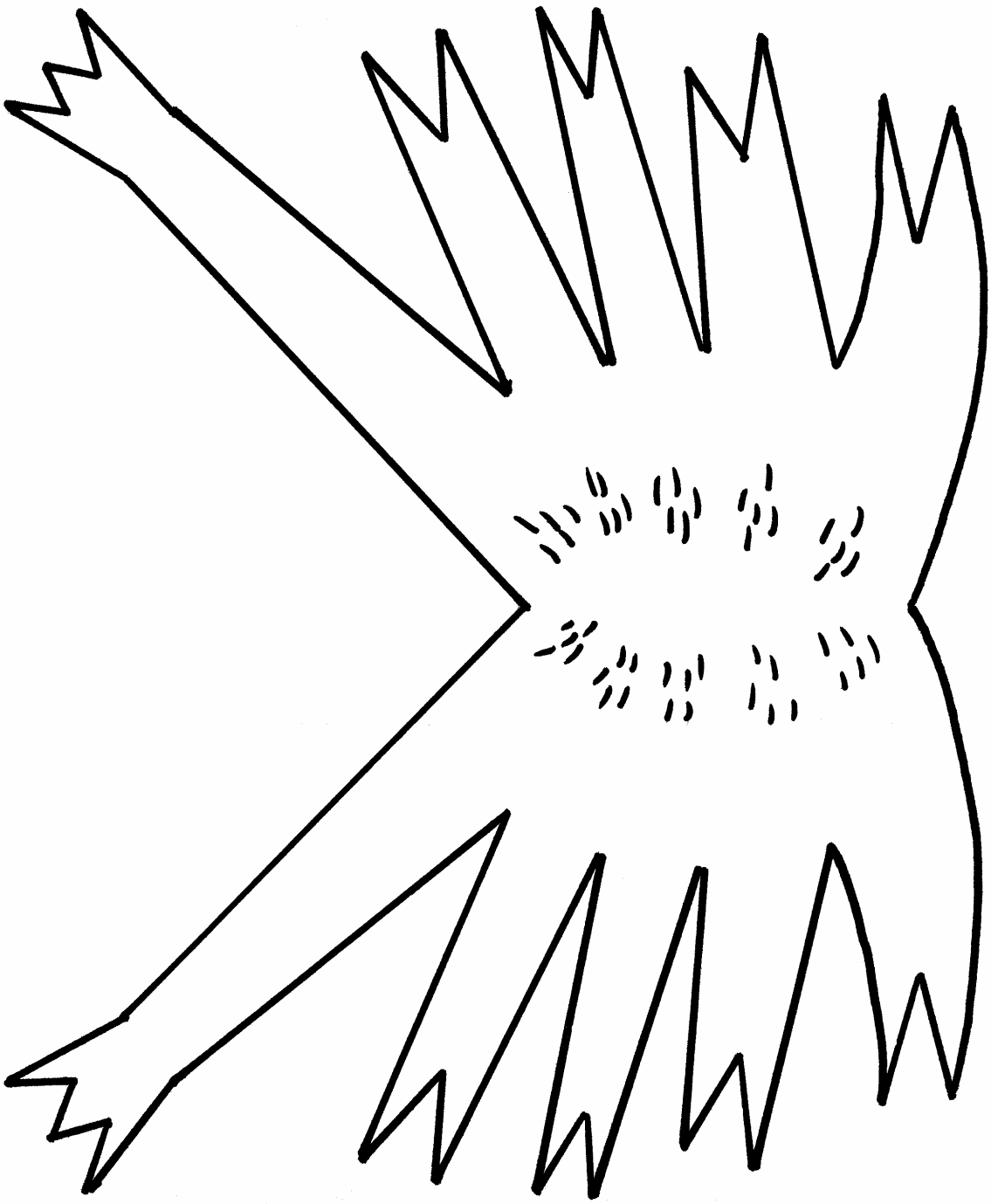
cut along dotted lines

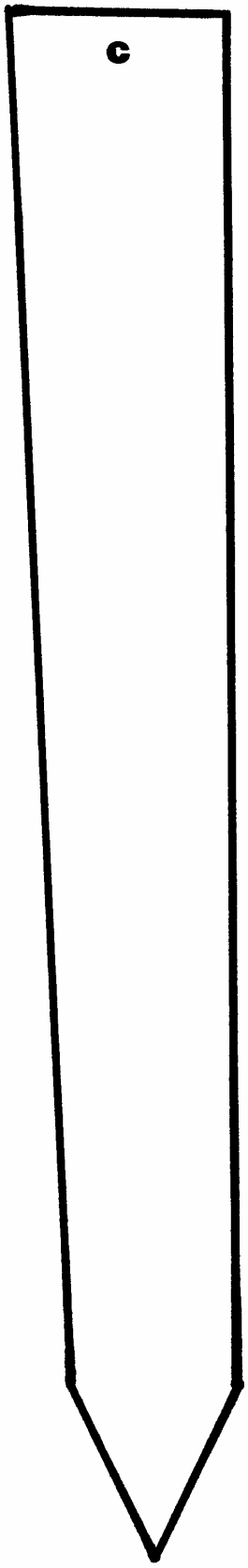
MIDDLE

(abdomen)



LEGS





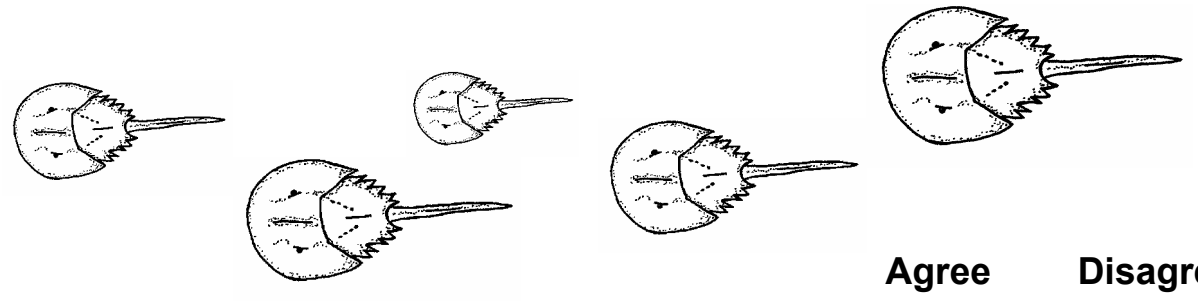
TAIL

(telson)

HORSESHOE CRAB WARM UP

This activity is designed to determine what students already know or believe about horseshoe crabs. It also makes a good post trip assessment as well. Have they changed their minds about previous answers?

Ask the students to answer these questions as a class or individually, before their field trip to the park. Have the students read each of the statements and mark agree or disagree depending on what they believe to be true. Explain to the class that they should try to explain why they made their choices. Of course, there will be incorrect answers! That is okay.



		Agree	Disagree
1.	**Horseshoe crabs are related to spiders.** Horseshoe crabs are not really crabs at all but more closely related to spiders, ticks, and scorpions.	✓	
2.	**Horseshoe crabs have lived on earth for millions of years.** Horseshoe crabs have lived on earth since before the time of dinosaurs.	✓	
3.	**Horseshoe crabs are dangerous.** Horseshoe crabs are harmless. Their tails are not stingers.		✓
4.	**Horseshoe crabs should be picked up by their tails.** Holding a horseshoe crab by the tail can weaken it so that it becomes useless for turning over or comes off altogether.		✓
5.	**Horseshoe crabs have red blood like humans.** Horseshoe crabs have blue, copper based, blood.		✓
6.	**Horseshoe crabs lay their eggs on the sandy beach.** Horseshoe crabs must come up onto the shore to lay their eggs, which will hatch a couple of weeks later.	✓	

HORSESHOE CRAB WORD SEARCH

ANSWER SHEET

Find these words hidden below.

ASSATEAGUE
BAY
BLUE BLOOD
BOOK GILLS
BOXING GLOVE
BROWN
CAMOUFLAGE
CLAMS
CLAWS
CRAWLS
EGGS
EYES
FOOD
HARMLESS
HORSESHOE CRAB
LIVING FOSSIL
OCEAN
PROTECTION
SANDY
SCISSOR SHAPED
SCORPION
SHELL
SHOREBIRDS
SPIDERS
SWIMS
TAIL
TELSON
TICKS
UPSIDE DOWN
WORMS

```
        H O R S E S H O E C R A B   B A Y
                          L           S
L I V I N G F O S S I L A   S W I M S
                          W           A
      W O R M S           S H E L L   T
            S H O R E B I R D S       E F
U P S I D E D O W N                   A O
            B O X I N G G L O V E S   G O
                                      U D
  S C I S S O R S H A P E D           E
B O O K G I L L S     C R A W L S
                      A           A
  P R O T E C T I O N M           N     S
S       A       I     O C E A N D     C
P       I       C     U             Y B     O
I       L       K     F               R     R
D H A R M L E S S   B L U E B L O O D P
E         Y           A               W     I
R         E           G               N     O
S   C L A M S       T E L S O N         N
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Post-Visit

WHELK EGG COUNTING

Generalization: Math skill can help students compare their observations with others. It can help them make predictions about things that occur in nature.

Objectives:
1. Students will practice counting, estimating and graphing skills.
2. Students will learn that math skill is an important element of scientific research.

Preparation: Collect a couple of whelk egg case while on your field trip. Make sure they rattle so you will have the small shells inside to work with. You may wish to cut small openings into the egg cases in advance so students can pour the small snails. If you do not have a full sized whelk shell available try to borrow one from another teacher or friend.

Materials: Whelk egg cases, full sized whelk shell, magnifying lenses, colored construction paper, scissors, paper, pencils.

Procedure:
Mix a little math fun with shell study. Students will closely observe the small shells in their egg cases and learn that some creatures must produce many young so that a few survive to reach maturity.

Whelks are a type of gastropod, "stomach foot." The whelk is a snail and like other univalves, it makes its own shell and carries it around wherever it goes. The body of the snail is literally attached to the shell. The shell acts as a moving shelter. Whelks are often mistaken for their close cousins, conchs. Though they are related, they have different feeding, behavior, and habitat requirements. Conchs are found in waters south of North Carolina. While some species of whelks are found as far south as Florida, they are associated with more northern waters.

The ocean is a difficult environment for young snails. They are a food source for many other creatures. As you will see, many of the young do not even escape from the egg case.

Have students break down into their cooperative learning groups. Give each group a capsule. If the capsule rattles when shaken it will probably contain shells to work with.

Students will:

1. Estimate the number of whelk shells they believe will be in their capsule. Record estimated number.
2. Cut an opening into the capsule and lay the tiny shells across the construction paper (they are easier to see in this manner).
3. Count the number of whelk shells their capsule. They may need to use the magnifying lens. Students should look closely at the small snail shells at this time and compare them with the full sized examples. Record the number of shells. If their capsule contains only sand or broken shells, students should record the results and try another capsule.
4. How close were the estimates to the actual counts? Record the difference.
5. Each group will estimate the combined class total of shells and record the number.
6. The groups will then share actual shell counts with the rest of the class. The numbers will be recorded and added together.
7. How does the group estimate match with the actual count? Record the difference.
8. Which group came closest in its single capsule count estimation to the actual count?
9. Which group came closest in its class count estimation to the actual count?
10. Discuss the methods groups used to come up with their estimations.
11. Create a graph featuring the range in the actual count.

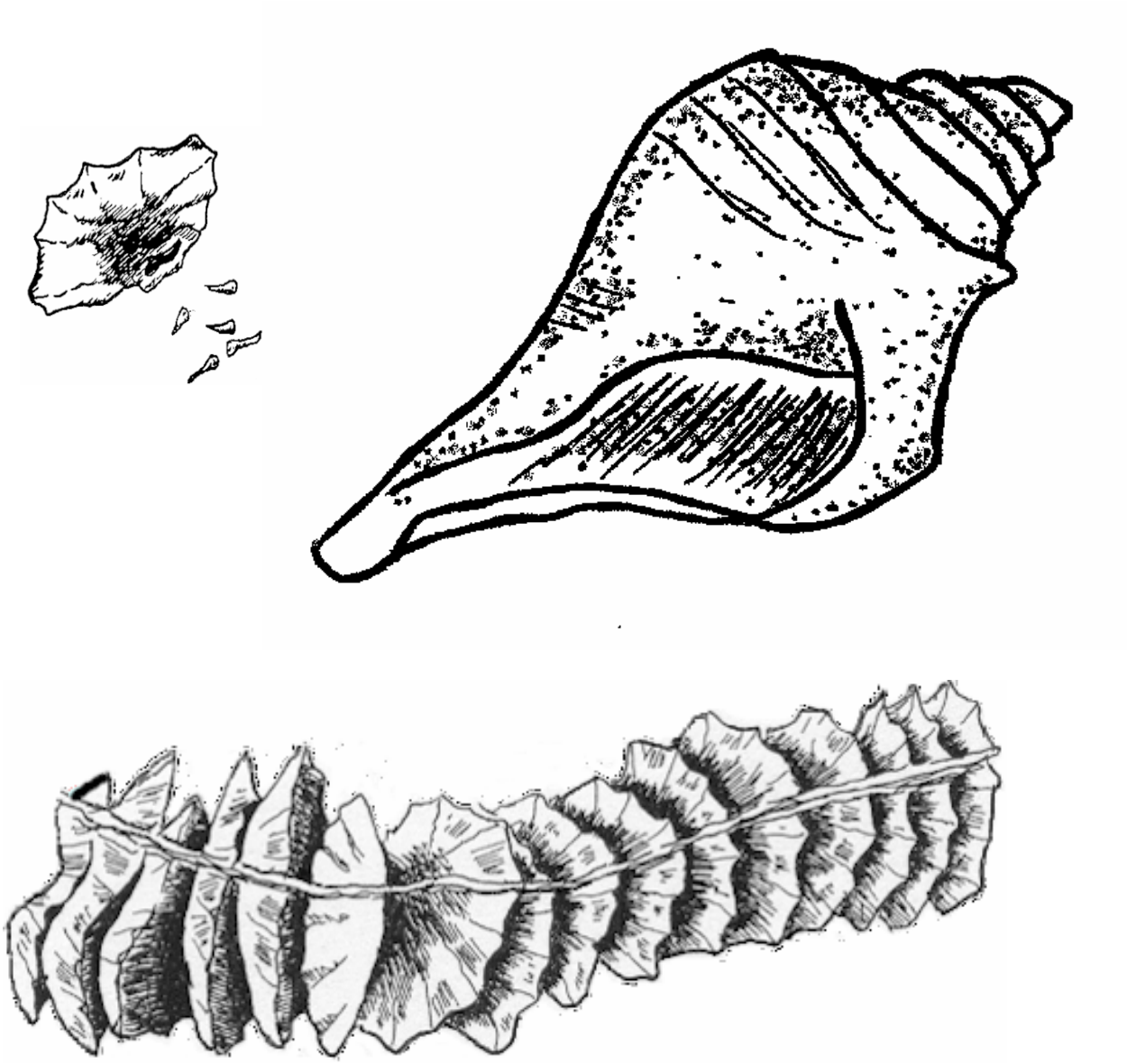
Scientists track the changes in animal populations using actual and estimated counts. Much can be learned about habitat change, disease, pollution, and reproductive success by analyzing information collected over many years.

Extensions:

Put all the shells together and arrange in sets of tens or fives.

Create a graph showing the relationships between the various estimations and actual counts.

Some whelk egg case strands may be 2 or 3 feet long. Calculate how many capsules per inch, per foot. Calculate how many whelks per capsule, per inch, per foot, etc. Convert to metric.



PATTERNS IN THE SAND

Generalization: Patterns exist everywhere in nature.

Objective: Students will create and identify patterns.

Preparation: Prepare examples of patterns to show the class (calendar, moon phase chart, multiples of three, etc). Point out examples of patterns while the classes are on their free time before or after island education programs.

Materials: Skate egg cases, whelk egg cases, clam or oyster pieces, any items collected during the visit to the island, paper or journals, and colored pencils. **(Note about collection: Shells and egg cases may be collected during your visit. Please think about instructing students to limit the number of items they bring back to class to 5 favorite items. Remember, instruct students that they may not pick vegetation or remove live creatures from the park.)**

Procedure:
This lesson was designed to introduce or review patterns. Arrange students in cooperative learning groups of four or five. They should have with them items they collected from the beach. Ask the students what ideas they have about patterns. Expect them to say things like repeats, copies, something to trace, etc. Show them some patterns, (Sunday, Monday, Tuesday,.....; high tide and low tide, the seasons, sunset and sunrise,.....) and ask them what comes next.

Have the students place all their beachcombing items on the table in front of them. Each student should somehow note their own beachcombing items so they can get them back later. Ask each group to design a pattern. There may be situations in which students wish to temporarily trade items with another table in order to create the pattern they have in mind. Again, students should be sure to note (mark them somehow?) which items they have traded. When they have finished placing the items in a pattern on the table or desk, each student in the group will make a sketch of the pattern on paper or in a journal. Allow twenty minutes.

Class discussion:
When all of the groups are finished recording their patterns, ask a representative from each to present the pattern on the chalkboard or overhead projector. After the group displays the pattern for the rest of the class, ask students to name the next few items in the pattern. This allows the teacher to assess whether or not the students can identify patterns. After all groups have presented, ask the class where else they have seen patterns like the ones they made. This could lead into the discussion of patterns in a tide chart, sheet music, tessellations (patterns placing congruent shapes together without leaving any spaces between the shapes), fabric patterns, wallpaper patterns and more.

STUDENT FIELD TRIP ASSESSMENT

Generalization: A student evaluation can be an effective assessment tool for teachers and park staff.

Objectives:

1. Students will describe whether or not they felt the experience was valuable to them as part of the curriculum.
2. Students will describe 3 things they learned during field trip or school visit.

Preparation: Make copies of the Student Evaluation sheet for each student.

Materials: Student and teacher evaluation sheets.

Procedure: This exercise is useful for both teachers and park staff. Students get an opportunity to share their thoughts and ideas with the education staff at Assateague Island. Teachers get another opportunity to observe what students take in during a field trip.

1. Distribute Student Evaluation worksheets.
2. Ask students to fill them out and explain that National Park education staff is interested in their comments.
3. Teachers might fill out the Teacher Evaluation while students are working on theirs.
4. Mail both sets of evaluations to:

   Liz Davis
   Education Coordinator
   Assateague Island National Seashore
   7206 National Seashore Lane
   Berlin, MD 21811

Classes sending in both teacher and student evaluations will receive additional classroom materials.

EVALUATION
Assateague Island National Seashore

Please share your thoughts with us. We need your help to provide the best educational experience possible.

School: _____

Grade Level: _____ Type of program: _____

Does the program relate to your curriculum? Explain.

_____

_____

Was the material presented at grade level? _____

Did the students enjoy the program? _____

Which activities were most effective and why? _____

_____

_____

Which activities were least effective and why? _____

_____

_____

Rate the extent to which the ranger was able to deliver the information in an interesting and enthusiastic manner.

Excellent Good Fair Poor Unable to Judge

Please comment if your response was "fair, poor, or unable to judge."

_____

_____

Please comment on any changes or additions that could be made to improve the visit.

_____

_____

_____

How did you use pre/post visit activities? Please comment on their effectiveness.

_____

_____

_____

Educators who fill out and return this evaluation to the address listed on the back will be sent additional classroom materials.

Thank you.
Please mail to:

Liz Davis
Education Coordinator
Assateague Island National Seashore
7206 National Seashore Lane
Berlin, MD 21811